19. Give the basic principle of ESR Spectroscopy. Explain the hyperfine structure. Describe a simple setup for the study of ESR.

20. Explain the application of a UV-Spectrophotometer.

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NOVEMBER/DECEMBER 2025

23PPH42 — SPECTROSCOPY

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What is the centrifugal distortion constant?

2. Explain the intensity of spectral lines.

3. What do you mean by fundamental vibrations and overtones?

4. How does hydrogen bonding affect the position of absorption in the Infra-red spectroscopy?

5. What do you understand by molecular polarization?

6. Write Rule of Mutual Exclusion.

7. Explain spin-spin and spin-lattice relaxation time.

8. How many spin states are possible for ^{1}H nucleus?

9. Define chromophore and auxochrome

10. What is a good solvent in UV-spectroscopy? Explain.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Discuss the rotational spectrum of a Diatomic rigid rotator.

Or

(b) Write about fundamental vibrations and vibrational spectra of symmetric polyatomic molecules.

12. (a) What are the P, Q and R branches of the vibration-rotation spectrum?

Or

(b) Describe the remote analysis of atmospheric gases like N_2O using FTIR by NRSC.

13. (a) Discuss in detail the molecular structure determination from IR and Raman spectrocopy.

Or

(b) Give a short note on SERS.

14. (a) Explain the chemical shift with examples.

Or

(b) Describe the instrumentation technique of NMR spectroscopy with necessary schematic diagram.

15. (a) Write a short note on UV spectra.

Or

(b) Explain in detail transmittance and absorbance in UV spectroscopy.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Explain the determination of bond length with the help of rotational spectroscopy.

17. With necessary Schematic diagram explain the working principle of an IR Spectrophotometer.

18. Give the classical and quantum theory of Raman Effect. Show that the stokes lines are more intense than that of antistokes lines.